

TABULAR KEYS & BIOLOGICAL NOTES TO COMMON PARASITOIDS OF SYNANTHROPIC DIPTERA BREEDING IN ACCUMULATED ANIMAL WASTES¹

E.F. Legner, I. Moore², G.S. Olton³

ABSTRACT: A tabular key and short discussion of salient biological characteristics are given for 9 genera and 14 species of parasitic insects commonly found attacking larvae and pupae of synanthropic Diptera in accumulations of animal wastes. Species included are, *Aleochara* sp., *Trichopria* sp., *Tachinaephagus zealandicus* Ashmead, *Phygadeuon* sp., *Stilpnus* spp., *Muscidifurax raptor* Girault & Sanders, *M. raptorellus* Kogan & Legner, *M. sp.*, nr. *raptorellus*, *M. raptoroides* K. & L., *M. uniraptor* K. & L., *M. zaraptor* K. & L., *Pachycrepoideus vindemiae* Rondani, *Spalangia cameroni* Perkins, *S. endius* Walker, *S. longepetiolata* Bouček, *S. nigra* Latreille, *S. nigripes* Curtis, *S. nigroaenea* Curtis, and *Sphegigaster* sp. Electron photomicrographs clarify the shape of certain diagnostic characters. References to other less common parasitoids, *Alysia manducator* (Panzer), *Figites* sp., are made; and pertinent literature references are given.

DESCRIPTORS: Medical Entomology; Diptera; Hymenoptera; Synanthropic Flies; Parasitoids; Tabular Keys.

Records of the activity of parasitoids from synanthropic muscoid Diptera developing in accumulated animal wastes such as are found in dairies and poultry ranches, are repetitious enough from diverse world collection sites that most major species are probably known (Ables and Shepard, 1974; Anonymous, 1972; Azab et al., 1963; Bouček, 1963; Bridwell, 1919; Feng, 1933; Girault, 1910; Girault and Sanders, 1910; Graham-Smith, 1916, 1919; Greenberg, 1971; Johnston and Bancroft, 1920; Johnston and Tieg, 1921; Kogan and Legner, 1970; Legner, 1965, 1966, 1967, 1969; Legner and Greathead, 1969; Legner and McCoy, 1966; Legner and Olton, 1968, 1971; Legner and Poorbaugh, 1972; Legner et al., 1967, 1974; Lindquist, 1936; Moore and Legner, 1971; Mourier, 1971; Mourier and ben Hannine, 1969; Muesebeck et al., 1951; Nikolskaya, 1952; Peck, 1963; Peck et al., 1964; Roy and Siddons, 1939; Steve, 1959; Sytshevskaya, 1963, 1964; Thompson, 1943; West, 1951.) The role of parasitoids in reducing the average density of their fly hosts can be significant, sometimes producing over 90% mortality of the later host developmental stages, with parasitoids attacking the pupal stage being predominant (Legner, 1971; Legner and Brydon, 1966; Legner and Dietrick, 1972, 1974; Legner and Greathead, 1969; Legner and Olton, 1971; Mourier and ben Hannine, 1969.) However, the degree of parasitization of muscoid Diptera that breed in isolated field pads of animal manure is comparably low with few of the parasitic species involved being common to those found in accumulated wastes (Legner et al., 1974; Olton and

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Legner, 1973). The characteristics of accumulated wastes cause an attraction for a distinct muscoid as well as parasitic fauna which is apparently related to a higher humidity and reduced rate of decomposition. Consequently, accumulated wastes are also a primary producer of flies of medical and veterinary importance such as the common house fly and several species of *Fannia*, and much attention has been placed on parasitoids to combat these flies.

The following keys and illustrations are presented in order to fill the need for a simple means of identification of the common parasitoids of synanthropic flies, principally the species *Musca domestica* L., *Stomoxys calcitrans* (L.), *Muscina stabulans* (Fallen), *Ophyra leucostoma* (Wiedemann), *Fannia canicularis* (L.), *F. femoralis* (Stein), and *F. scalaris* (Fab.). The parasitoids of these flies are currently being exchanged around the world in biological control attempts. The following species are included:

COLEOPTERA

Staphylinidae

1. *Aleochara* sp.

HYMENOPTERA

Diapriidae

2. *Trichopria* sp.

Encyrtidae

3. *Tachinaephagus zealandicus* Ashmead

Ichneumonidae

4. *Phygadeuon* sp.

5. *Stilpnus* sp.

Pteromalidae

6. *Muscidifurax raptor* Girault & Sanders
7. *M. raptorellus* Kogan & Legner
8. *M.* sp. nr. *raptorellus*
9. *M. raptoroides* Kogan & Legner
10. *M. uniraptor* Kogan & Legner
11. *M. zaraptor* Kogan & Legner
12. *Pachycrepoideus vindemiae* Rondani
13. *Spalangia cameroni* Perkins
14. *S. endius* Walker

15. *S. longepetiolata* Bouček^v
16. *S. nigra* Latreille
17. *S. nigripes* Curtis
18. *S. nigroaenea* Curtis
19. *Sphегigaster* sp.

Parasitic species not frequently encountered or very restricted in their original distribution are *Alysia manducator* (Panzer) (Braconidae) from northern Europe and Uruguay and *Figites* sp. (Figitidae) (Hewitt, 1914; James, 1928; Legner and Olton, 1968) with one species infrequently found in several areas. Other even rarer species are reported (Dresner, 1954; Ho et al., 1974; Howard, 1911; Roy et al., 1940).

The construction and use of tabular keys employed here are given by Newell (1970, 1972). Scanning electron micrographs are included for some species where the general shape of a character may be useful in its identification.

TABULAR KEY TO THE COMMON PARASITOIDS
OF SYNANTHROPIC FLIES
KG1.

STATEMENT OF CHARACTERS

1. Venation of forewing = VEN. FORE.
RED. = membranous; venation reduced, no complete cells present.
COMP. = membranous; venation not reduced, at least one complete cell present.
CORN. = corneous, no venation.
2. Number of antennal segments = NO. ANT. SEGS.
LESS 14 = less than fourteen.
16 = sixteen.
22 = twenty-two.
3. Location of antennae = LOC. ANT.
MID. NO PLAT. = inserted in the middle of the face, not on a small platform.
MID. PLAT. = inserted in the middle of the face on a small platform.
ANT. NO PLAT. = inserted at the anterior margin of the face, not on a platform.
4. Ratio of length of marginal vein to length of stigmal vein of forewing = RAT. MARG. STIG.
10.1 = ten to one.
NONE = no venation.
NO STIG. = stigmal vein absent or greatly reduced.
5. Pubescence between eye facets = PUB. EYE.
PUB. = pubescence present.
GLAB. = glabrous.
6. Length of first antennal segment = LENG. ANT. ONE.
LONG = longer than next two segments combined.
SHORT = shorter than next two segments combined.

TABULAR KEY TO THE COMMON PARASITOIDS
OF SYNANTHROPIC FLIES
KGI.

VEN. FORE	NO. ANT. SEGS.	LOC. ANT.	RAT. MARG. STIG.	PUB. EYE	LENG. ANT. SEG. ONE	
CORN.	LESS 14	MID. NO PLAT.	NONE	GLAB.	SHORT	$\overline{\text{KGI}}$ <i>Aleochara</i> spp.
COMP.	22	MID. NO PLAT.	NO. STIG.	GLAB.	SHORT	$\overline{\text{KGI}}$ <i>Phygadeuon</i> sp.
COMP.	16	MID. NO PLAT.	NO STIG.	GLAB.	SHORT	$\overline{\text{KGI}}$ <i>Stilpnus</i> sp.
RED.	LESS 14	MID. NO PLAT.	2.1	GLAB.	LONG	$\overline{\text{KGI100}}$ <i>Muscidifurax</i> spp.
RED.	LESS 14	MID. NO PLAT.	1.1	GLAB.	LONG	$\overline{\text{KGI}}$ <i>Pachycrepoides vindemiae</i> Rondani
RED.	LESS 14	ANT. NO PLAT.	10.1	PUB.	LONG	$\overline{\text{KG200}}$ <i>Spalangia</i> spp.
RED.	LESS 14	MID. NO PLAT.	6.1	PUB.	LONG	$\overline{\text{KGI}}$ <i>Sphlegaster</i> sp.
RED.	LESS 14	MID. NO PLAT.	1.1	PUB.	LONG	$\overline{\text{KGI}}$ <i>Tachinaephagus zealandicus</i> Ashmead
RED.	LESS 14	MID. PLAT.	NO. STIG.	PUB.	LONG	$\overline{\text{KGI}}$ <i>Trichopria</i> sp.

TABULAR KEY TO THE SPECIES OF *Muscidifurax*.
STATEMENT OF CHARACTERS
KG100.

1. Marginal fringe = MARG. FRIN.
PRES. = fringe of setae present on postero-apical margin of forewing.
ABS. = fringe of setae absent from postero-apical margin of forewing.
2. Length of stigma = LENG. STIG.
ELONG. = stigma longer than wide.
SHORT = stigma about as long as wide.
3. Frontal grooves = FRONT. GROOV.
PARAL. = parallel.
US. PAR. = usually parallel.
CONV. = convergent.
US. CONV. = usually convergent.
4. Spiracular ridge = SPIR. RIDGE
SHORT = spiracular ridge shorter than diameter of spiracle.
LONG = spiracular ridge as long as diameter of spiracle.
5. Mating behavior = MAT. BEH.
BIP. = biparental.
UNIP. = uniparental.
6. Progeny per host = PROG. HOST.
SOL. = solitary.
PAR. GREG. = partially gregarious.
GREG. = gregarious.
7. Possible Origin = ORIG.
W.U.S.A. = Western United States.
UR. & ARG. = Uruguay and Argentina.
P.R. = Puerto Rico.
C.A. = Mexico and Central America.
COSM. = Unknown, now cosmopolitan.

TABULAR KEY TO THE SPECIES OF
Muscidifurax
KG100.

MARG. FRIN.	LEN. STIG.	FRONT GROOV.	SPIR. RIDGE	MAT. BEH.	PROG. HOST	ORIG.
ABS.	ELONG.	US. PAR.	SHORT	BIP.	SOL.	W.U.S.A. <i>zaraptor</i>
ABS.	SHORT	US. CONV.	SHORT	BIP.	GREG.	CHILE <i>raptorellus</i>
ABS.	ELONG.	US. PAR.	SHORT	BIP.	PAR. GREG.	UR. & ARG. sp. near <i>raptorellus</i>
PRES.	ELONG.	PARAL.	SHORT	BIP.	SOL.	COSM. <i>raptor</i>
PRES.	ELONG.	CONV.	LONG	UNIP.	SOL.	P.R. <i>uiraptor</i>
PRES.	ELONG.	CONV.	SHORT	BIP.	SOL.	C.A. <i>raptoroides</i>

TABULAR KEY TO THE COMMON SPECIES OF
Spalangia ASSOCIATED WITH SYNANTHROPIC FLIES.
STATEMENT OF CHARACTERS
KG200.

1. Condition of posterior disc of pronotum = COND. PRON. DISC
 LINE = pronotum with an isolated crenulate line parallel to and near posterior margin.
 NO LINE = pronotum without an isolated crenulate line parallel to and near posterior margin.
2. Pronotal Border = PRON. BORD.
 BORD. = Pronotal collar bordered anteriorly by a narrow groove setting off the ridge-like margin.
 ROUND = pronotal collar rounded anteriorly.
3. Texture of pronotum = TEXT. PRON.
 RUG. = antero-lateral surface of pronotum rugose or crowdedly rugulose punctured.
 PUNC. = antero-lateral surface of pronotum umbilicately punctured with interspaces smooth.
4. Puncturation of head = PUNC. HEAD
 DENS. = disc of head between the eyes very densely crowdedly punctured, the punctures separated by less than their diameters.
 SPARS. = disc of head between the eyes sparsely punctured, the punctures separated by about their diameters.
5. Length of gena = LEN. GEN.
 LONG = longer than length of eye.
 EQUAL = equal to length of eye.
 SHORT = shorter than length of eye.
6. Dorsal carinae on abdominal petiole = PET. DORS. CAR.
 7-10 = number of carinae, longitudinally arranged.
 5-8 = number of carinae, longitudinally arranged.
 IRR. = irregularly arranged carinae.
7. Lateral hairs on abdominal petiole = LAT. PET. HAIR.
 PRES. = present, at least 10 on each side.
 RARE = not more than 2 on each side, usually absent.
 ABS. = absent.
8. Possible Origin = ORIG.
 COSM. = Unknown, now cosmopolitan
 HOLA. = Holarctic.
 EA. AFR. = East Africa.

TABULAR KEY TO THE COMMON SPECIES OF
Spalangia ASSOCIATED WITH SYNANTHROPIC FLIES
KG200.

COND. PRON. DISC.	PRON. BORD.	TEXT. PRON.	PUNC. HEAD	LENG. GENA	PET. DORS. CAR.	LAT. PET. HAIR	DISTR.
LINE	BORD.	RUG.	SPARS.	SHORT	7-10	PRES.	COSM. <i>nigroaenea</i>
LINE	ROUND	RUG.	SPARS.	LONG	7-10	ABS.	COSM. <i>cameroni</i>
LINE	ROUND	RUG.	SPARS.	SHORT	5-8	ABS.	EA.AFR. <i>longepetiolata</i>
LINE	ROUND	PUNC.	SPARS.	EQUAL	7-10	RARE	COSM. <i>endius</i>
NO LINE	ROUND	RUG.	DENS.	LONG	5-8	PRES.	HOLA. <i>nigra</i>
NO LINE	ROUND	PUNC.	SPARS.	SHORT	IRR.	ABS.	HOLA. <i>nigripes</i>

1. *Aleochara* spp. (Coleoptera: Staphylinidae).

Members of this group are characterized by the forewings being developed into corneous shields (elytra) under which the hind wings (the actual organs of flight) are folded in repose. In this family the elytra are short, leaving much of the abdomen exposed. The abdomen is highly flexible. The genus *Aleochara* differs from other staphylinids in that the antennae are inserted on the face between the anterior margins of the eyes, the tarsi are all five-segmented, the maxillary palpi are five-segmented and the labial palpi four-segmented. The two terminal segments of the palpus are considerably narrower than the preceding with the last segment minute. All members of this genus in which the life histories are known are solitary ectophagous parasitoids on the pupae of flies within the puparium (Kemner, 1926; Lesne and Mercier, 1922; Moore and Legner, 1971, 1973; White and Legner, 1966).

2. *Phygadeuon* sp. (Hymenoptera: Ichneumonidae)

Members of this genus, along with those of *Stilpnus* can be distinguished from other species listed here by their complete wing venation. Both the forewings and hind wings have the venation closed to form several cells. This genus is unique here in having the antennae of 22 segments with the first two segments short and the third segment longer than the first two combined. The antennae are inserted in the middle of the face between the eyes. The species are solitary internal larval parasitoids most commonly found in humid higher Holarctic latitudes (Legner, 1966; Legner and Olton, 1968). Their size varies with the size of the host.

3. *Stilpnus* sp. (Hymenoptera: Ichneumonidae)

As in *Phygadeuon* the wing venation is complete, there being complete cells in both the forewings and hind wings. The antennae are of 16 segments with the first two segments short, the first being shorter than the next two together. The color is a shining metallic black. These are solitary endophagous larval parasitoids, apparently restricted to the genus *Fannia* in accumulated animal wastes (Legner and Olton, 1971; Loomis et al., 1968). They vary greatly in size with males being about half that of females.

Genus *Muscidifurax* (Hymenoptera: Pteromalidae)

In this genus the wing venation is incomplete and the marginal vein is about twice as long as the stigmal vein. The antennal insertions are in the middle of the face between the eyes. The first antennal segment is longer than the next two together. There are less than 14 antennal segments. Females

have one ring segment and seven funicular segments, males have two and six, respectively. The disc of the pronotum and the head are finely reticulate, without coarse punctures (Fig. 1). The few species are very similar in appearance but have good behavioral characters distinguishing them (Legner, 1969; Kogan and Legner, 1970). Females are black; males black with translucent testaceous spots on the first, second and third ventral abdominal segments. The eggs are hymenopteriform, covered with small tubercles which distinguishes them from those of *Spalangia* (Gerling, 1967) and with size differences for some species. The species may be either solitary or gregarious. The average mass of solitary species of this genus is relatively fixed as host size does not appreciably affect them (Legner, 1969). They are ectophagous pupal parasitoids. The key reference is Kogan and Legner (1970). Van den Assem and Povel (1973) discuss courtship behavior patterns that are species specific. Markwick (1974) gives biological characteristics that distinguish *M. raptor* and *M. zaraptor* and these species from *Spalangia endius*. Other references refer to distribution, identity and biology of species of this genus (Ables and Shepard, 1974; Anonymous, 1938; Broadbent, 1972; Frison, 1927; Kotschetova and Tjutjunkova, 1972; Legner, 1967, 1969a, 1972; Legner and Dietrick, 1974; Legner and Gerling, 1967; Legner et al., 1965; McCoy, 1967; Nikolskaya, 1952; Wylie, 1967, 1971a, b, 1972).

4. *Muscidifurax zaraptor* Kogan & Legner

A fringe of setae (or their sockets) is absent from the postero-apical margin of the forewing. The stigma is small, elongate, suboval, frequently acuminate at the internal angle where a hair is implanted. The uncus is usually directed toward the anterior margin of the wing. The pedicel of the antenna of the female is conspicuously slender proximally. The frontal grooves are usually parallel. The median area of the propodeum in the female is closed behind by the fusion of the lateral and median plicae. The digitus of the male genitalia is subrectangular with four or five apical processes. Length of female 2.84 mm, male 2.18 mm. This species is biparental and solitary. It was originally found in the western United States, but is now known to extend into southwestern Canada.

5. *Muscidifurax raptorellus* Kogan & Legner

A fringe of setae (or their sockets) is absent from the postero-apical margin of the forewing. The stigma is not elongate; sometimes it is roundly clubbed. The uncus is directed towards the apex of the wing. The pedicel of the antenna of the female is not slender proximally. The frontal grooves are usually convergent. The median area of the propodeum of the female is

usually open behind with the lateral and median plicae not fused in the middle (Fig. 1). The digitus of the male genitalia is subtrapezoidal, broader distally and usually with only three distal processes. Length of female is 2.11 mm, male 1.82 mm. This species is biparental and gregarious. It was originally known from Chile.



Fig. 1. Thorax of *Muscidifurax raptorellus* Kogan & Legner, showing shape and relative dimensions of pronotum (100 X).

6. *Muscidifurax* sp. near *raptorellus*

The fringe of setae (or their sockets) is absent from the postero-apical margin of the forewing. The stigma is elongate. The uncus is directed apically. The pedicel of the antenna of the female is not slender proximally. The frontal grooves are usually convergent. The median area of the propodeum of the female is usually open behind with the lateral and median plicae not fused

in the middle. The digitus of the male genitalia is subtrapezoidal, broader distally and usually with only three distal processes. Length of female is 2.11 mm, male 1.82 mm. It is biparental and partially gregarious (not more than 10% of the time). This species is known from Uruguay.

7. *Muscidifurax raptor* Girault & Sanders

The fringe of setae (or their sockets) is well developed on the postero-apical margin of the forewing. The stigma forms a rather abrupt enlargement at the end of the stigmal vein, usually subquadrangular and distally acuminate where a hair is frequently implanted. The uncus is directed distally. The frontal grooves are parallel. The median area of the propodeum of the female is closed behind. The digitus of the male genitalia is subtrapezoidal, broadest distally and usually with three apical processes. Length of female is 2.33 mm, male 1.73 mm. It is biparental and solitary. A nearly cosmopolitan species which has not been collected in Asia.

8. *Muscidifurax uniraptor* Kogan & Legner

The fringe of setae (or their sockets) is well developed on the postero-apical margin of the forewing. The stigma is formed as a gradual dilation of the tip of the stigmal vein. The uncus is directed distally. The frontal grooves are convergent. The digitus of the male genitalia is subrectangular and usually with four distal processes. The spiracle of the female propodeum is remote from the lateral plica, i.e., the spiracular ridge is as long as the longest diameter of the spiracle. Length 2.15 mm in females; the occasional males are the smallest of all the *Muscidifurax* species. This species is uniparental and solitary. It was originally known only from Puerto Rico at an elevation of 3000 feet.

9. *Muscidifurax raptoroides* Kogan & Legner

The fringe of setae (or their sockets) is well developed on the postero-apical margin of the forewing. The stigma is formed as a gradual dilation of the tip of the stigmal vein. The uncus is directed distally. The frontal grooves are convergent. The digitus of the male genitalia is subrectangular and usually with four apical processes. The spiracle of the propodeum of the female is not remote from the lateral plica, i.e., the spiracular ridge is shorter than the largest diameter of the spiracle. Length of female is 2.31 mm, of male 1.78 mm. This species is biparental and solitary. It was originally known from Costa Rica.

Another population, originally known from Mexico, is morphologically very similar to this species. The two populations apparently do not cross freely, but tests conducted so far are not conclusive.

(To be concluded in May-June issue)

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(Continued on inside of back cover)

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TABULAR KEYS & BIOLOGICAL NOTES TO COMMON PARASITOIDS OF SYNANTHROPIC DIPTERA BREEDING IN ACCUMULATED ANIMAL WASTES

(Concluded from March-April issue)

E.F. Legner, I. Moore, G.S. Olton

10. *Pachycrepoideus vindemiae* Rondani (Hymenoptera: Pteromalidae)

This species is similar in appearance to species of *Muscidifurax* but can readily be distinguished by the short marginal vein which is not longer than the stigmal vein. The wing venation is incomplete. The antennae arise from the middle of the face between the eyes with the first segment longer than the next two together. There are less than 14 antennomeres. The head and the disc of the pronotum are finely reticulate without noticeable punctures. This species is an ectophagous, usually solitary, pupal parasitoid; its distribution is cosmopolitan. Some references are Crandall (1939), Legner and Olton (1968), Legner et al. (1967), Nostvik (1954), Steve (1959), and van den Assem (1974).

Genus *Spalangia* (Hymenoptera: Pteromalidae)

Species of this genus have incomplete wing venation. The marginal vein is about ten times as long as the stigmal vein. The antennae are located at the front margin of the head. The first antennal segment is longer than the next two combined. There are less than 14 antennomeres. The pronotal disc is coarsely punctured with polished interspaces (Fig. 2). The eggs are hymenopteriform and smooth with the size being variable according to the species (Gerling, 1967). Host size does not appreciably affect the size of solitary species of this genus (Legner, 1969). These species are usually solitary ectophagous pupal parasitoids. The five species treated here are easily distinguished among themselves. The key reference is Bouček (1963). Markwick (1974) gives biological characteristics of *S. endius* and distinguishes this species from *Muscidifurax*. Other references include Azizov (1972), Brethes (1915), Cameron (1881), Gerling and Legner (1968), Handschin (1934), Kotschetova and Azizov (1972), Legner (1967), McCoy (1963), Mourier (1971), Pinkus (1913), Richardson (1913), Simmonds (1929a, b), Vandenburg (1928, 1931), Wylie (1972).

11. *Spalangia nigroaenea* Curtis

The disc of the head between the eyes is sparsely punctured with the punctures separated mostly by about their diameters. The disc of the pronotum has an isolated crenulate crossline consisting of closely spaced large punctures in front of and parallel to the posterior margin. The pronotal collar is bordered anteriorly by a narrow groove setting off the ridge-like margin

(Fig. 3 & 4). The antero-lateral surface of the pronotum is rugose or crowdedly rugulose punctured. The length of the gena is less than that of the eye. The ratio of abdominal petiole length to the narrowest width is 1.7 in females and 2.2 in males (Fig. 5 & 6). The length of the stretched body is 2.9-3.8 mm in females and 2.5-3.5 mm in males. This species is cosmopolitan.

12. *Spalangia cameroni* Perkins

The disc of the head between the eyes is sparsely punctured with the punctures mostly separated by more than their diameters. The disc of the pronotum has an isolated crenulate crossline consisting of large closely spaced punctures near to and parallel to the posterior margin. The pronotal collar is rounded anteriorly, without a distinct ridge (Fig. 7 & 8). The antero-lateral surface of the pronotum is rugose or crowdedly rugulose punctured. The length of the gena is less than that of the eye. The ratio of abdominal petiole length to the narrowest width is 1.8 in females and 2.5 in males (Fig. 9 & 10). The length of the stretched body is 2.5-3.3 mm in females and 2.4-3 mm in males. A cosmopolitan species.

13. *Spalangia longepetiolata* Bouček

The disc of the head between the eyes is sparsely punctured, the punctures being separated mostly by more than their diameters. The disc of the pronotum has a distinct crenulate cross line of large crowded punctures parallel to and just anterior to the posterior margin (Fig. 11 & 12). The pronotal collar is rounded at the anterior margin. The antero-lateral surface of the pronotum is rugose or crowdedly rugulose punctured. The length of the gena is greater than that of the eye. The ratio of abdominal petiole length to the narrowest width is 1.7 in females and 3-5 in males (Fig. 13 & 14). Therefore, females do not possess the long petiole characteristic that generated the name of this species from Bouček, 1963. The length of the stretched body is ca. 2.2-3.1 mm in females and 2-2.8 mm in males. This species was originally known from East Africa.

14. *Spalangia endius* Walker

The disc of the head between the eyes is sparsely punctured with the punctures mostly separated by more than their diameters. The disc of the pronotum has an isolated crenulate crossline consisting of large closely placed punctures in front of and parallel with the posterior margin (Fig. 15 & 16). The pronotal collar is rounded anteriorly, without a distinct ridge. The antero-lateral surface of the pronotum is umbilicately punctured with the interspaces smooth, not rugose. The length of the gena is about equal to that



Fig. 2. Punctures on pronotum in female *Spalangia endius* Walker, showing seta in one of them (1500 X).

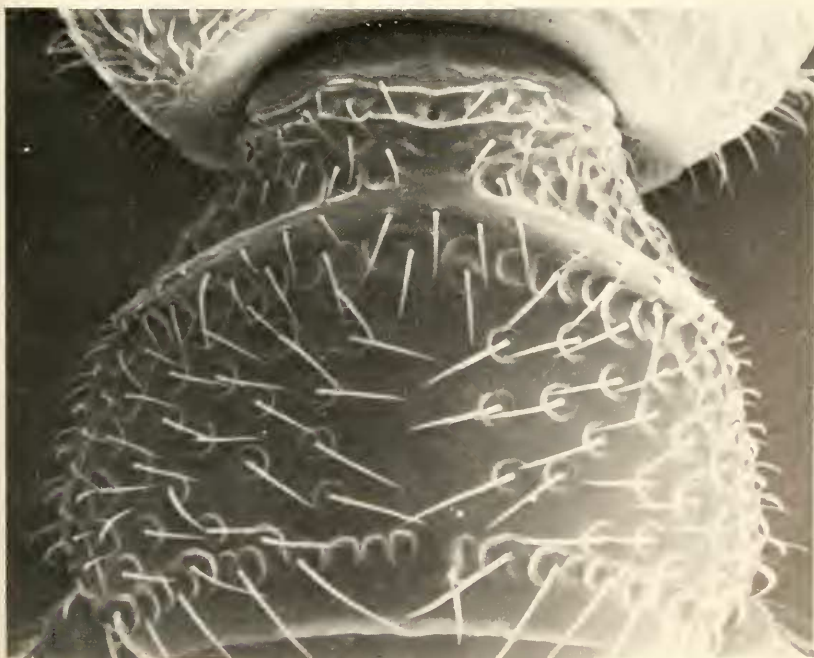


Fig. 3. Pronotum in female *Spalangia nigroaenea* Curtis (170 X).

of the eye. The ratio of abdominal petiole length to the narrowest width is 1.7 in females and 2.0 in males (Fig. 17 & 18). The length of the stretched body is 2-3 mm in females and 1.9-2.6 mm in males. A cosmopolitan species.

15. *Spalangia nigra* Latreille

The disc of the head between the eyes is very densely crowdedly punctured, the punctures being separated by less than their diameters. The pronotum is without a distinct crenulate line of large punctures parallel to the posterior margin (Fig. 19). The pronotal collar is rounded anteriorly without a distinct ridge. The antero-lateral surface of the pronotum is rugose or crowdedly rugulose punctured. The length of the gena is greater than that of the eye. The ratio of abdominal petiole length to the narrowest width is 2 in females and 2.2 in males (Fig. 20). The length of the stretched body is 3-4.5 mm in females and 2.5-3.7 mm in males. This was originally a Holarctic species.

16. *Spalangia nigripes* Curtis

The disc of the head between the eyes is sparsely punctured, the punctures being separated mostly by more than their own diameters. The disc of the pronotum is without a distinct crenulate cross-line of large crowded punctures parallel to and just anterior to the posterior margin. The pronotal collar is rounded at the anterior margin. The antero-lateral surface of the pronotum is umbilicately punctured with the interspaces smooth. The length of the gena is less than that of the eye. The ratio of abdominal petiole length to the narrowest width is 1.6 in females. The length of the stretched body is 2.5-3.7 mm in females and 2-3.1 mm in males. This species was originally Holarctic in distribution.

17. *Sphegigaster* sp. (Hymenoptera: Pteromalidae)

The wing venation is greatly reduced with a single vein along the anterior margin and a spur, the stigmal vein near its apex. The antennae are located on the middle of the face between the anterior margins of the eyes, not on a platform. They are of less than 14 segments with first segment elongate, longer than the next two combined. The pronotal disc is finely densely punctured. The color is shining black with the legs testaceous. The abdomen is noticeably smaller than the thorax in contrast to other genera treated here.

Sphegigaster sp. was originally found active on *Musca domestica* and *Stomoxys calcitrans* only in East and South Africa (Legner & Greathead, 1969; Legner & Olton, 1968); however, the genus is well represented by a number of species in the Palearctic (Graham, 1969).



Fig. 4. Pronotum in male *Spalangia nigroaenea* Curtis (175 X).



Fig. 5. Abdominal petiole in female *Spalangia nigroaenea* Curtis (215 X).

18. *Tachinaephagus zealandicus* Ashmead
(Hymenoptera: Encyrtidae)

The wing venation is greatly reduced with a single vein along the margin and a very short spur, the stigmal vein, near its center. The antennae are located in the middle of the face between the eyes. They are of less than 14 segments with the first segment elongate, longer than the next two combined. As in *Muscidifurax*, the pronotal disc is finely reticulate and almost imperceptibly punctured. The color is shining black with the underside of the thorax and the legs testaceous. The size varies with host size and number of individuals developing on one host. The eggs are encyrtiform (dumbbell shaped). It is an endophagous gregarious larval parasitoid which was originally known from Australasia. The key reference is Olton & Legner (1975). Other references are Ashmead (1904), Gahan (1938), Gourlay (1930), Ferriere (1933), Johnston and Tiegs (1922), Legner and Olton (1968), Olton and Legner (1974), Risbec (1956).

19. *Trichopria* sp.
(Hymenoptera: Diapriidae)

The wings are without veins except for a short marginal vein and with a stigma so near the margin that the stigmal vein is almost absent. The antennae in this family usually arise from a small platform in the middle of the face between the eyes. The femora and apical half of the tibiae are swollen. The body is highly polished black without ground sculpture and with scattered long setae. The size varies with that of the host. The species of this genus are usually solitary endophagous larval parasitoids. Key references are Legner and Olton (1968), Legner et al. (1967), and Muesebeck (1961).

GLOSSARY

- Digitus** of the male genitalia. Paired finger-like structures at base of the aedeagus.
- Frontal Grooves.** A pair of impressed grooves in the center of the head between the eyes running from the antennal insertions in the direction of the median ocellus.
- Funicular Segments** of antenna. The median segments following the small ring segment or segments but not including the terminal club.
- Gena.** The sides of the head below the eyes.
- Hymenopteriform Egg.** Ovoid or spindle shaped in outline, both ends smoothly rounded.
- Lateral and Median Plica.** A fold or wrinkle on the propodeum.
- Marginal Vein.** That vein which runs along the anterior basal portion of the wing beyond the sub marginal.
- Petiole** of abdomen. The narrow basal segment or segments of the abdomen.
- Pronotal Collar.** The posterior region of the pronotum.
- Propodeum.** The posterior lateral sclerite of the metathorax.
- Ring Segments** of the antenna. One or two small or minute segments between the second segment and the funicle.
- Spiracular Ridge.** A short ridge extending from the mesothoracic spiracle to the lateral plica.
- Stigma.** A thickened enlargement of the distal end of the stigmal vein.
- Stigmal Vein.** A short vein extending from the distal end of the marginal vein into the surface of the anterior wing.
- Synanthropic Flies.** Flies coexisting with man over an extended period and whose density is partially or wholly governed by him.
- Uncus.** A finger-like distal process of the stigma.

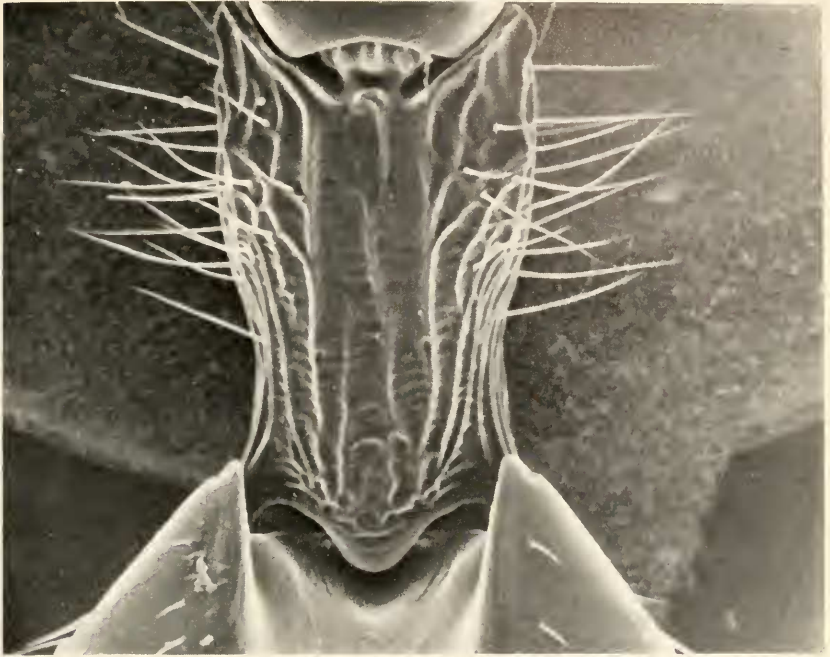


Fig. 6. Abdominal petiole in male *Spalangia nigroaenea* Curtis (190 X).

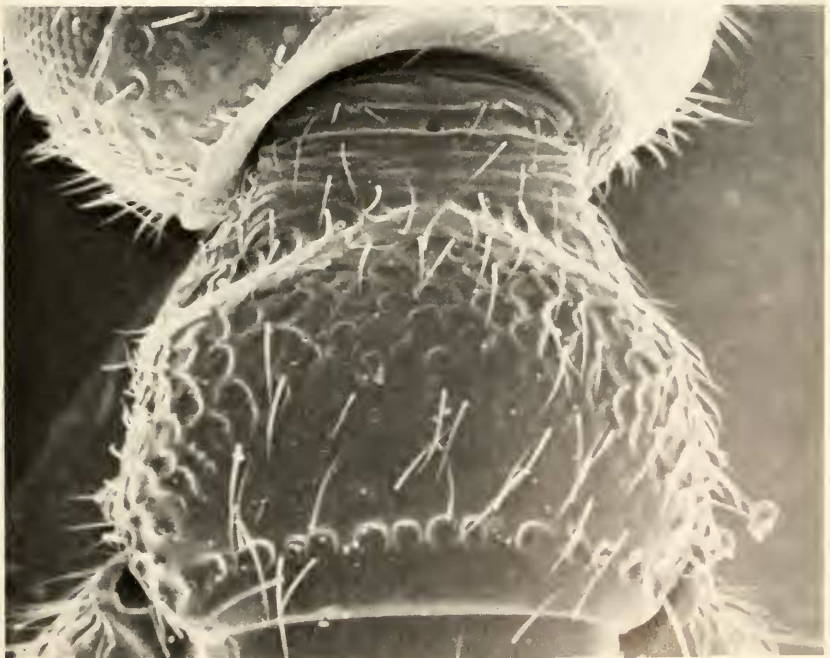


Fig. 7. Pronotum in female *Spalangia cameroni* Perkins (170 X).

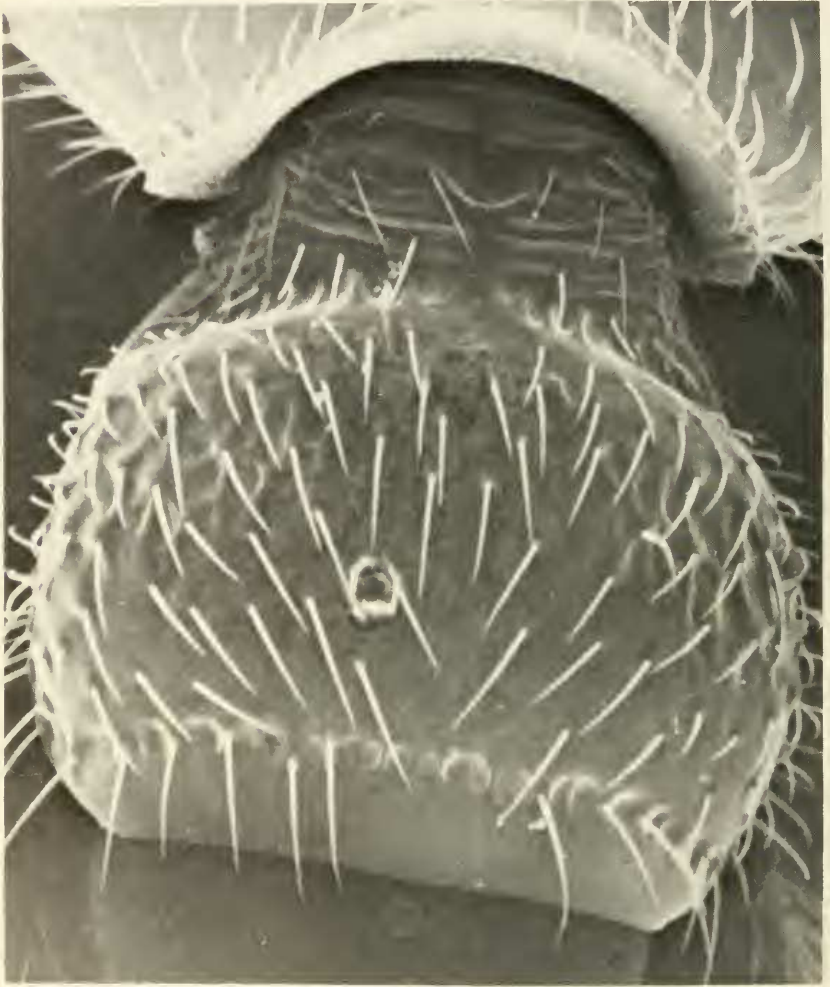


Fig. 8. Pronotum in male *Spalangia cameroni* Perkins (170 X).



Fig. 9. Abdominal petiole in female *Spalangia cameroni* Perkins (215 X).

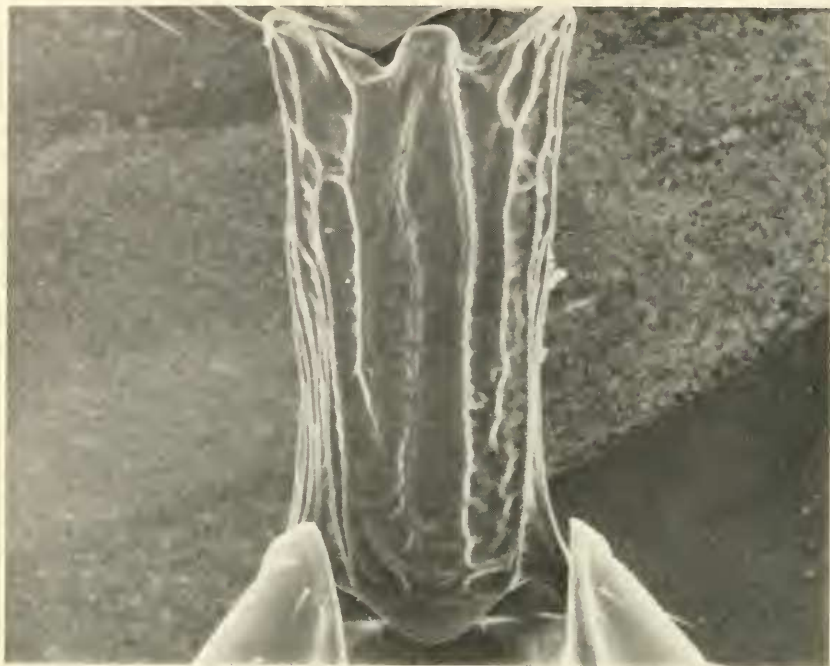


Fig. 10. Abdominal petiole in male *Spalangia cameroni* Perkins (215 X).

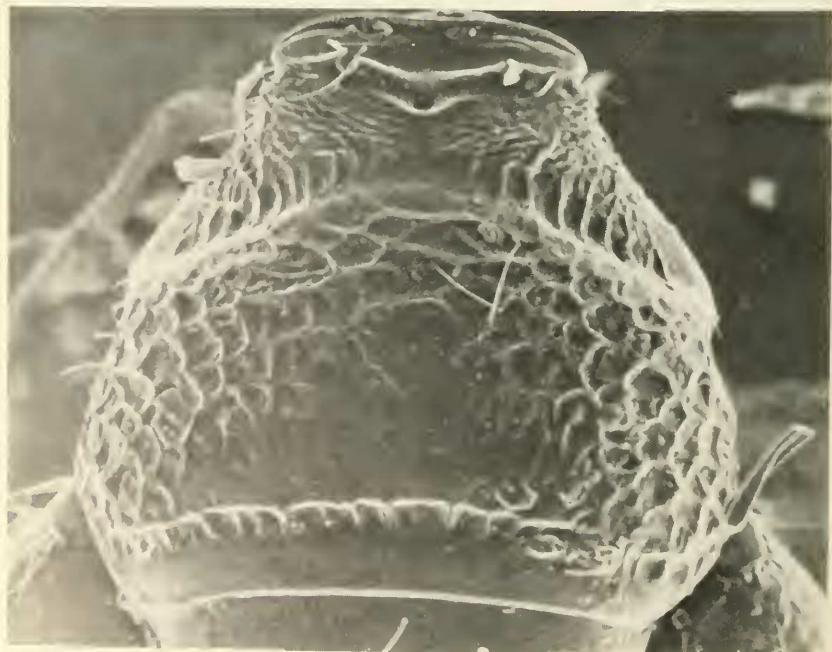


Fig. 11. Pronotum in female *Spalangia longepetiolata* Bouček (150 X).



Fig. 12. Pronotum in male *Spalangia longepetiolata* Bouček (170 X).



Fig. 13. Abdominal petiole in female *Spalangia longepetiolata* Bouček (170 X).



Fig. 14. Abdominal petiole in male *Spalangia longepetiolata* Bouček^V (170 X).



Fig. 15. Pronotum in female *Spalangia endius* Walker (190 X).



Fig. 16. Pronotum in male *Spalangia endius* Walker (190 X).



Fig. 17. Abdominal petiole in female *Spalangia endius* Walker (215 X).

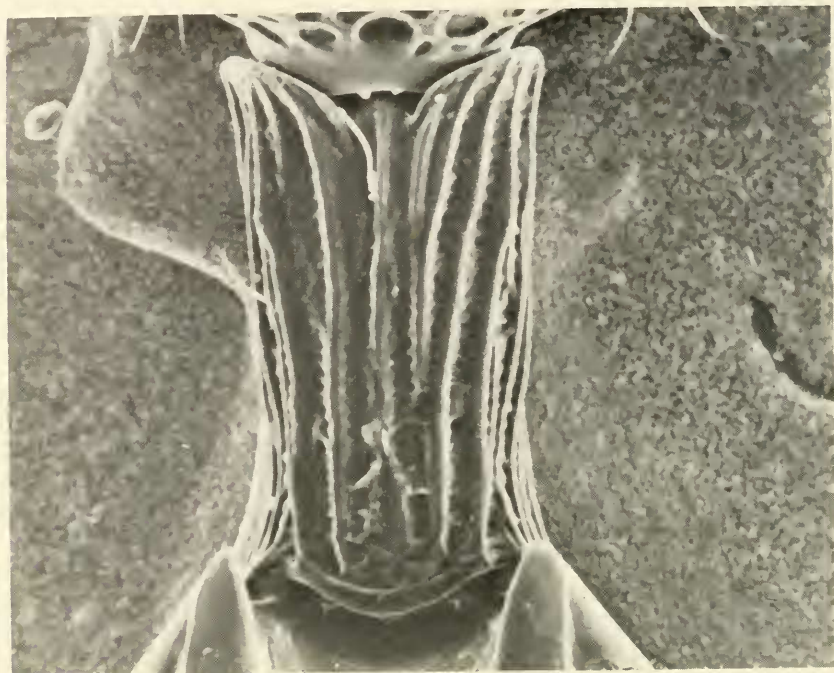


Fig. 18. Abdominal petiole in male *Spalangia endius* Walker (215 X).



Fig. 19. Pronotum in female *Spalangia nigra* Latreille (170 X).

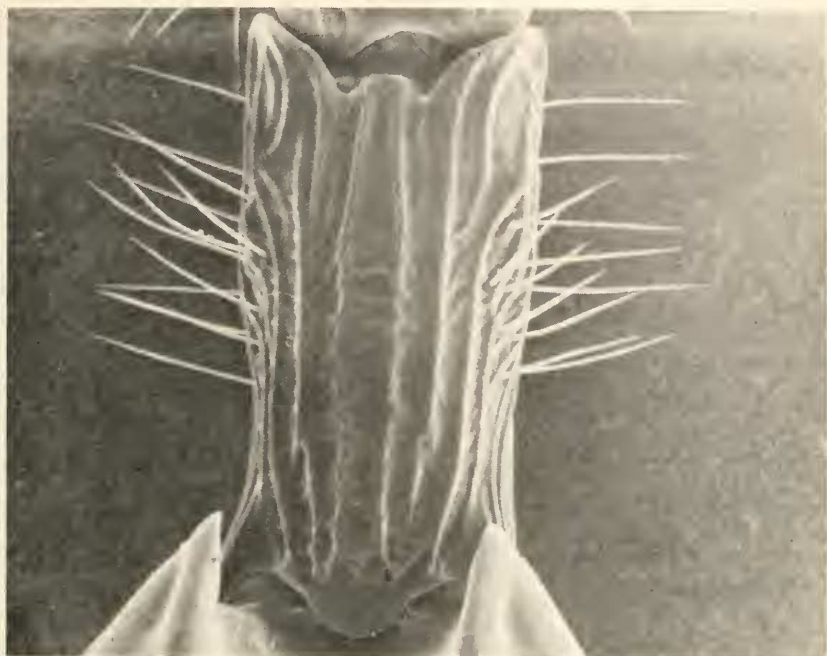


Fig. 20. Abdominal petiole in male *Spalangia nigra* Latreille (190 X).

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